



Virtual Learning

Aerospace Engineering

Space Shuttle Tires

April 16, 2020



Aerospace Engineering

Lesson: April 16, 2020

Objective/Learning Target:

Students will learn about tire technology and air pressure concepts.

Bell Work:

What do you think are the differences between a tire on your car and a tire on a space shuttle?

Let's Get Started:

Watch Videos:

- [Space Shuttle Tire at Kennedy Space Center](#)
- [Space Shuttle Endeavour at California Science Center with Michelin tires](#)



Landing the Shuttle

Definitions You Need to Know:

Bead - A high-strength steel wire and rubber that hold the plies and the tire assembly onto the rim of the wheel.

Orbiter - the part of the Space Shuttle remaining after the rocket boosters and fuel tank have been released upon launch

PSI - Pounds per square inch

Sidewall - The part of the tire between the bead and the tread.

Tire Class: The group or category to which the tire belongs (ex: P=Passenger, LT=light truck).



Landing the Shuttle

Even though a Space Shuttle leaves Earth vertically attached to a rocket, it lands horizontally, like an airplane. Because of this, a space shuttle needs a landing gear system that has struts, shock absorbers and most importantly, tires. Space Shuttles normally land at the Kennedy Space Center in Florida, with Edwards Air Force Base in California as an alternate runway during periods of unfavorable weather.



Landing the Shuttle

To land, the orbiter aligns with the runway. It begins a steep descent with its nose angled as much as 19 degrees down from horizontal. This is seven times steeper than the average commercial airliner landing. This causes the shuttle to descend toward the runway 20 times faster. At 2,000 feet above, the nose of the shuttle raises, which slows both the rate of descent and airspeed in preparation for touchdown. At 250 feet above the ground, the speed slows to less than 345 mph and the landing gear is deployed and locked into place. At touchdown, the main landing gear tires touch the runway first at 220 mph. Then, the nose gear lowers slowly as the orbiter loses speed. If needed, a parachoot can be deployed to assist in slowing the orbiter as well as keeping directional control on the runway.

Shuttle Tires

The shuttle has two main landing gears, which have two tires each. There are also two tires on the nose landing gear, that makes a total of six tires. The shuttle tires are filled with Nitrogen because of its stability at different altitudes and temperatures. Nitrogen molecules are larger than Oxygen molecules, so Nitrogen is less likely to escape from the tires, resulting in a gradual loss of pressure over time. Nitrogen also isn't flammable so that prevents problems should a tire puncture when landing. The orbiter weighs approximately 240,000 lbs. Because of this, its tires are inflated to a higher pressure than the tires of a small plane or car. The main gear tires are inflated to 315 psi while the nose gear is inflated to 300 psi. The main gear tires are only able to be used one time, while the nose gear tires can be used for two landings.

Tire Basics

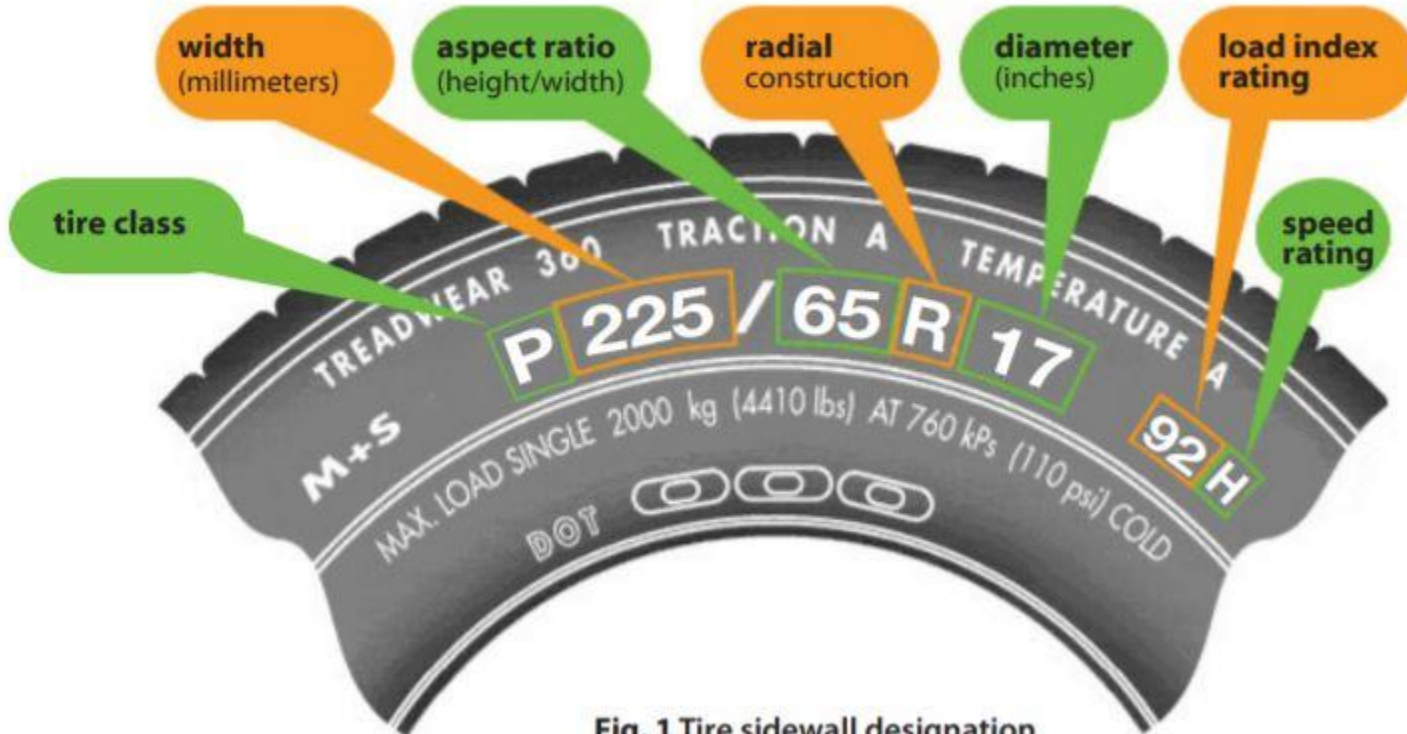


Fig. 1 Tire sidewall designation

Tire Basics

P designates the tire's class.

- In the picture provided, "P" indicates that the tire is a passenger car tire.
- LT would designate it as a light truck tire.

225 is the tire's width measured in mm. This measurement is taken from sidewall to sidewall.

65 is the aspect ratio of the tire. The aspect ratio refers to the height of the sidewall as a percentage of the section width.

R refers to the tire construction. R is a radial tire. C refers to a cross-ply tire.



Tire Basics

17 refers to the wheel diameter in inches.

92 refers to the load index for the tire. Load index ranges from 0 to 279 and corresponds with the load-carrying capacity of a tire. Passenger car tire load indices typically range from 75 to 105.

H indicates the speed rating for the tire, which is the maximum speed the tire is allowed to travel according to the manufacturer's recommendation.



Space Shuttle Tires Understanding

Research the following specifications of a space shuttle tire:

Tire Class

Width (mm)

Aspect Ratio

Construction

Diameter (in)

Load Index Rating

Speed Rating



Space Shuttle Tires Understanding

Look at the following specifications of a tire of one of your vehicles:

Tire Class

Width (mm)

Aspect Ratio

Construction

Diameter (in)

Load Index Rating

Speed Rating